

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
16 September 2004 (16.09.2004)

PCT

(10) International Publication Number
WO 2004/078314 A1

(51) International Patent Classification⁷: **B01D 33/04**,
D21F 1/00, B23D 29/00, B29C 67/00, B01D 39/14, B29C
43/22, B32B 27/12, B21D 5/04, D21F 1/80

(21) International Application Number:
PCT/EP2004/050250

(22) International Filing Date: 4 March 2004 (04.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0305236.2 7 March 2003 (07.03.2003) GB

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

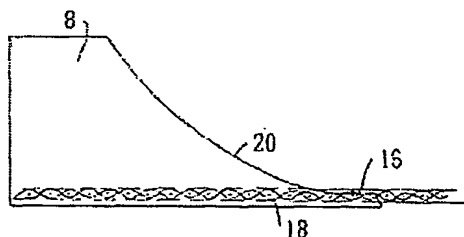
(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), Euro-
pean (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,
GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: WASHER BELT



(57) Abstract: DNT washer belt comprising a length of fabric and
at least one edge guide (8), the edge guide and the fabric (16) being
joined together whereby the edge guide extends into the longitudinal
direction of said fabric and forms a protruding portion of said belt,
whereby said edge guide is casted in one piece and being joined with
said fabric during the casting process.

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Washer Belt

The present invention relates to washer belts of the type used on high speed double nip thickening machines also known as DNT washers, and to a process for making such belts.

5

DNT washers are used during the manufacturing of paper from waste paper products, and in particular, but not exclusively in the manufacture of tissue paper. Generally, waste based stock which is an aqueous slurry of paper materials derived from waste paper, has too high an ash content for
10 tissue making. The DNT washer is used to remove inorganic components such as inks, fines, fillers and dirt from the stock, whilst also thickening the stock. The DNT washer 30 as illustrated in Fig. 6 comprises two rolls in the form of a worm roll 32 and a plain roll 34, and an endless porous washer belt 36 stretched around the rolls 32, 34. In use, the stock 38, at approximately
15 60°C, is injected into the receding nip 40, formed between the worm roll 32 and the belt 36. The stock is dewatered as it is squeezed between the underside 42 of the belt 36 and the worm roll 32. In addition to water, inorganic contaminants such as inks etc are also expressed through the belt 36 from the stock 38 with the liquor. For this purpose the fabric of the belt has
20 a plurality of pores (not illustrated), sized to allow such contaminants to be washed therethrough whilst not allowing acceptable fibres to escape from the stock. The remaining stock 38 then travels on the belt 36 to the plain roll 34 whereat it is further dewatered about the plain roll 34. The thickened, purer stock is then doctored off the plain roll 34 at 44 and conveyed out of the DNT
25 washer 30 by a screw conveyor 46.

Post removal of the stock, the belt is washed by oscillating showers 48 which are capable of delivering water at up to 20 bar pressure. The stock is not uniformly deposited onto the belt, leading to uneven loading.
30 Furthermore, the belt in use is subjected to a tension roll (not illustrated) with approximately 30cm throw, resulting in a tension of 2.5kg/inch and a velocity of up to 750m/min. Each of these operating conditions means that the belt 36

is prone to move obliquely. In order to prevent this, as best illustrated in Fig. 7, the belt is provided with an edge guide 50 along each of its edges which fit into corresponding grooves 52 about the rolls 32, 34. These ensure correct tracking of the belt 36, thereby preventing it from slipping from the rolls 32, 34, whilst also retaining the stock within the washer by blocking the exit of the stock from the rolls.

A conventional edge guide is in the form of a projecting flat rubber rib 50 which has been sewn onto the fabric of the belt 36. During operation of the DNT washer the stock is congregated into tubes by the coarse worm roll, with the result that the fabric is subjected to regular high/low pressures. Furthermore, the fabric of the belt is also being worked by the outwardly directed forces emanating from the worm roll 32 which lead to belt rupture, mainly in the machine direction, as well as damage to the edge guides 50 resulting in their tearing from the fabric. Furthermore, the stitching connecting the rubber rib 50 to the belt fabric tends to wear in the regions where it is prominent, and the perforations made by the sewing needle are a frequent cause of failure to the rubber component. Furthermore, the rubber rib tends to cut into the fabric, leading to early belt failure. Additionally, referring to Fig. 7, point A on the fabric is in direct contact with the corner of the groove 52 in the rollers 32, 34, rendering it prone to high frictional forces and consequential abrasion of the fabric. Also, as there is considerable down time when replacing a belt, it is therefore desirable to improve the longevity of the belt.

US 5,391,427 (Scapa Group plc) describes a drum filter belt with an edge track made from a thermoplastic olefin material which has been welded to the belt, thereby providing a longer working life because of the absence of stitching. To weld the track to the belt, the track is pre-vulcanised, a length of reinforcing material is then stitched or welded to the edge of the filter cloth and the track is welded to the reinforcing fabric using a jet of hot air, the heat of which softens the olefin content of the track material causing adherence of the track to the reinforcing fabric. This known track protrudes from the end

surface of the belt edge, and is thereby not suitable for engagement within the guide tracks provided in the rolls of the DNT washer. The presence of the reinforcing material further making it unsuitable for adaption, since such would reduce filtration and would provide an increased risk of de-lamination from and/or cutting of the fabric, since operating conditions would put pressure on its connection to the filter fabric of the belt.

EP 0,712,957 (Nippon) describes a DNT washer belt comprising a fabric of three layers of weft consisting of a plastic monofilament, a bending resistant part in the form of a 30 to 50mm wide sheet of thermoplastic resin overlapped on and fused to one surface of the edge of the fabric, and a thermoplastic edge guide fused on the opposite side of the fabric to the bending resistant part. The bending resistant part and the edge track are each made from the same thermoplastic material, and are each individually fused under heat and pressure to the fabric, causing partial penetration of each into the fabric in a two step procedure. The edge track is intended to run in the edge guides in the rolls of the DNT washer, whilst the bending resistant part reduces flexing of the belt to reduce cutting of the fabric. The width of the bending resistant part is not less than 30mm, and is only present on the upper surface. Because this bending resistant part ends abruptly, the fabric at that point is particularly vulnerable to flexing, which may lead to premature fabric abrasion. Also, there is no bending resistant part on the underside attached to the edge guide to prevent flexing and/or abrasion of the fabric by the edge of the groove in the rolls of the DNT machine. The two step procedure in fusing is also inflexible and time consuming, rendering the belt expensive to manufacture and subject to de-lamination. Furthermore, the cloth is prone to heat damage from the fusing process.

JP 11021780 (Nippon Filcon Co Ltd) describes an improvement to belt of EP 0712957 whereby the bending resistant part gradually reduces in thickness as it extends over the fabric belt. This acts to spread the flexing of the belt over a region, rather than being directed mainly at the edge region of

the bending resistant part, thereby reducing potential cutting of the belt. However, this belt still has the same drawbacks as EP 0,712,957 (Nippon) with respect to the two step procedure in fusing and abrasion to the fabric via its contact with the corner of the groove of the rolls, and cutting at its lower
5 surface adjacent the edge guide.

It is an object of the present invention to provide a DNT washer belt and a method of manufacture thereof which overcomes or alleviates the above described disadvantages.

10

In accordance with a first aspect of the present invention there is provided a DNT washer belt comprising a length of fabric with a cast, elongate, monocoque edge guide. By providing the edge guide in one piece, the incidence of delamination is reduced.

15

Preferably the edge guide is substantially in the form of a trapezoid. This shape readily engages in the grooves of the DNT washer rolls.

20 In a preferred embodiment the edge guide comprises a thermoset polymer. This enables the guide to be formed without the application of heat, thus avoiding potential heat damage to the fabric of the belt.

Preferably, the edge guide and fabric are integral and a portion of the edge guide extends through the thickness of the fabric. This further reduces
25 the risk of delamination.

More preferably, the edge guide forms a reinforcing skin on the opposite side of the fabric. This again further reduces the risk of delamination.

30

In a preferred embodiment the edge guide is resilient. The flexibility may be achieved by selection of at least one flexible material to construct the

guide and/or by providing flexure points within the guide. The flexure points may take the form of a series of spaced grooves in the guide. This provides greater flexibility to the guide, which enables the DNT belt to run on the DNT washer with greater ease.

5

In a preferred embodiment the guide track comprises at least one gradually tapered edge. The tapered edge may run along the surface of the fabric and/or may taper within the fabric. This provides a graduation in the pliancy of the fabric in the region of the cast guide edge, which prevents the fabric from flexing due to fatigue at one location in the running direction of the fabric. This reduces the incidence of tearing and thereby increases the longevity of the belt. Furthermore, the tapered edge additionally reduces abrasion to the fabric in use by acting as a protective surface between the fabric and the corner of the grooves in the rolls on a DNT machine.

15

In a preferred embodiment the fabric has two such edge tracks and they extend along opposite edges of the fabric.

The fabric and/or edge guide(s) may be endless.

20

In accordance with a second aspect of the present invention there is provided a method of manufacture of a DNT washer belt comprising a length of fabric with an elongate monocoque edge guide, comprising the steps of casting the guide by providing a thermosettable polymer in an elongate mould on one side of the fabric and pushing the polymer through the fabric such that as it sets the edge guide forms in one piece with its guide part protruding from one side of the fabric and a portion of the material of the guide fully impregnating adjacent portions of the fabric.

25

In accordance with a third aspect of the present invention there is provided an apparatus for forming a DNT washer belt comprising an endless fabric with a cast, elongate monocoque edge guide, the apparatus comprising

an endless casting belt having a circumferential groove which extends around the casting belt and which groove forms a mould for the guide edge, wherein one side of the groove has a chamfered surface.

- 5 Preferably, the apparatus further comprises a non-stick belt adapted to extend over the groove of the casting belt and being adapted to engage the casting belt with a compressive force.

The non-stick belt may have a substantially flat surface or may carry a
10 forming edge.

By way of example only, specific embodiments of the present invention will now be described with reference to the accompanying drawings, in which:-

- 15 Fig. 1 is a schematic cross-sectional view of an apparatus for production of a DNT washer belt of the invention;
Fig. 2 is a schematic view of the edge section of a DNT washer belt constructed using the apparatus of Fig. 1;
20 Fig. 3 is a detailed view of a second embodiment of edge guide;
Fig. 4 is a schematic perspective view of a third embodiment of edge guide; and
Fig. 5 is a side view of the edge track of Fig. 4;
25 Fig. 6 is a schematic view of a DNT washer; and
Fig. 7 is a sectional schematic view of the fitting of a conventional washer belt to the rolls of a DNT washer.

Referring to Fig. 1 a DNT washer belt of the present invention is
30 constructed using a casting belt 2 with a circumferential groove 6 therein which extends about the belt 2. The groove 6 forms a mould for forming an edge guide 8 (as best illustrated in Fig. 2). The groove 6 is substantially

trapezoid shaped and has a chamfer 12 at an outer edge surface of one side thereof. The apparatus further comprises a flat non-stick belt 14.

An edge guide 8 to a belt 10 is produced as follows:

5 A polyurethane, thermoset, polymer is placed as a two component system (diisocyanate and polyol) into the groove 6. The fabric 16 of the DNT belt is then placed over the casting belt 2, and pressed between the casting belt 2 and non-stick belt 14, such that the thermoset polymer is pushed through the belts fabric fully impregnating the fabric and as the polymer sets
10 leave a reinforcing skin 18 on the opposite side of the fabric 16 to the edge guide 8. Once the edge guide has set, the DNT belt with the newly formed monocoque edge guide is easily removed from the non-stick belt 14 and non-stick casting belt 2.

15 The chamfered surface 12 of the casting belt produces a tapered area 20 at one surface of the edge guide 8, which edge faces towards the centre of the DNT belt. This provides a graduation of the pliancy of the fabric in the vicinity of the cast edge track, which graduation reduces flexing and thereby reduces the incidence of the edge guide cutting the fabric; hence improving
20 the longevity of the belt.

 The taper 20 is illustrated in Fig. 2 as gradually tapering in a concave manner from the top 22 towards the base 18 of the edge guide 8. In a further embodiment, illustrated in Fig. 3 the tapering 20 of the edge is mainly
25 contained within the body of the fabric 16.

 In the embodiment of Figs. 4 and 5 the edge guide 8 includes a plurality of transverse grooves 26 along its top surface 22. The grooves 26 are formed by providing a series of corresponding forming protuberances (not
30 illustrated) along the belt 2 within the groove 6, such that when the fabric 16 of the DNT belt is placed over the polymer containing groove 6 and pressed

between the casting belt 2 and non-stick belt 14, the protuberances form the grooves 26 within the top surface 22 of the edge guide 8.

5 The preceding specific embodiments are illustrative of the practice of the invention. It is to be understood, however, that other expedients known to those skilled in the art as disclosed herein may be employed without departing from the spirit of the invention.

Claims:

1. DNT washer belt comprising a length of fabric and at least one edge guide, the edge guide and the fabric being joined together whereby the edge guide extends into the longitudinal direction of said fabric and forms a protruding portion of said belt,
5 c h a r a c t e r i z e d i n
 that said edge guide is casted in one piece and being joined with said fabric during the casting process.
2. DNT washer belt according to claim 1,
10 c h a r a c t e r i z e d i n
 that said edge guide substantially is in the form of a trapezoid.
3. DNT washer belt according to claim 1 or claim 2,
 c h a r a c t e r i z e d i n
 that said edge guide comprises a thermoset poymer.
- 15 4. DNT washer belt according to at least one of the preceding claims,
 c h a r a c t e r i z e d i n
 that said edge guide extends at least in sections through the thickness of said fabric.
- 20 5. DNT washer belt according to at least one of the preceding claims,
 c h a r a c t e r i z e d i n
 that said edge guide forms a reinforcing skin on the side of said fabric opposite to the protruding side of said edge guide.
- 25 6. DNT washer belt according to at least one of the preceding claims,
 c h a r a c t e r i z e d i n
 that said edge guide comprises flexible or resilient material.

7. DNT washer belt according to at least one of the preceding claims,
c h a r a c t e r i z e d i n
that said edge guide provides flexure points.
- 5 8. DNT washer belt according to claim 7,
c h a r a c t e r i z e d i n
that said flexure points are a series of spaced grooves in the edge
guide.
- 10 9. DNT washer belt according to at least one of the preceding claims,
c h a r a c t e r i z e d i n
that said edge guide comprises at least one gradually tapered edge.
10. DNT washer belt according to at least one of the preceding claims,
c h a r a c t e r i z e d i n
that said tapered edge runs along the surface of the fabric and / or
within the fabric.
- 15 11. DNT washer belt according to claim 9 or 10,
c h a r a c t e r i z e d i n
that said edge is gradually tapering in a concave manner from the top
of the edge guide towards the fabric.
- 20 12. DNT washer belt according to at least one of the preceding claims,
c h a r a c t e r i z e d i n
that said belt comprises two of said edge guides extending along
opposite edges of said fabric.

13. Method of manufacturing a DNT washer belt having a length of fabric and at least one edge guide extending into the longitudinal direction of said fabric and forming a protruding portion of said belt, the method comprising the following steps:
- 5 - casting a edge guide by providing a polymer in an elongated mould on one side of the fabric,
- pushing the polymer through the fabric and forcing the polymer to impregnate areas of the fabric such that the protruding portion and the impregnating portion of the edge guide is formed in one piece,
- 10 - setting of the polymer,
- removing the mould from the cured edge guide.
14. Method of manufacturing a DNT washer belt according to claim 13 or 14,
- c h a r a c t e r i z e d i n
- 15 that said polymer impregnates the fabric through its whole thickness.
15. Apparatus for manufacturing a DNT washer belt comprising an casting belt having a groove which extends along the casting belt thereby forming an elongated mould.
16. Apparatus according to claim 15,
- 20 c h a r a c t e r i z e d i n
- that said casting belt is an endless belt and that said groove extends circumferentially around said casing belt.
17. Apparatus according to claim 16,
- c h a r a c t e r i z e d i n
- 25 that at least one side of the groove of said casting belt has a chamfered surface.

18. Apparatus according to one of the claims 15 to 17,

c h a r a c t e r i z e d i n

that the apparatus further comprises a non-stick belt adapted to extend
over the groove of said casting belt and being adapted to engage the
casting belt with a compressive force.

5

19. Apparatus according to claim 18,

c h a r a c t e r i z e d i n

that said non-stick belt has a substantially flat surface and / or a
forming edge.

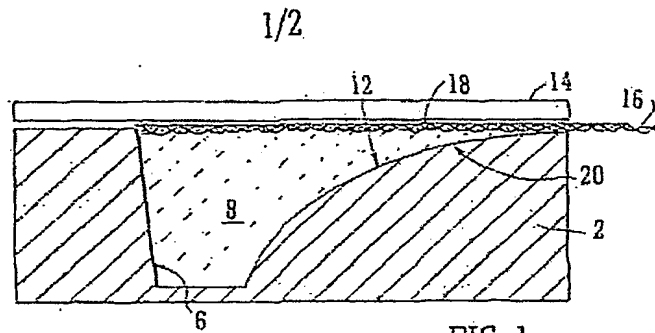


FIG. 1

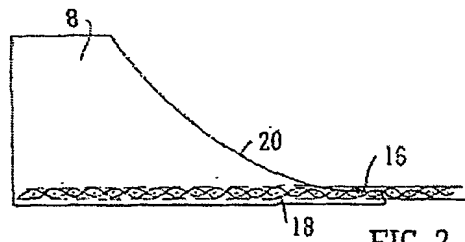


FIG. 2

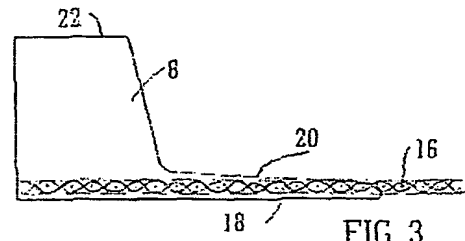


FIG. 3

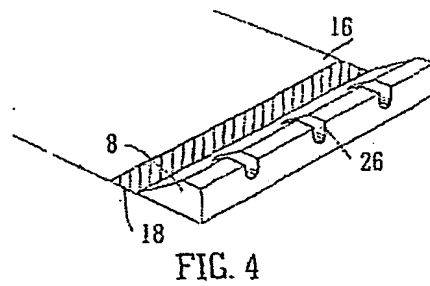


FIG. 4

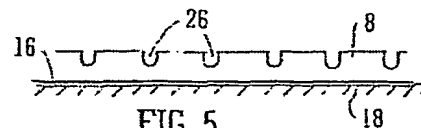


FIG. 5

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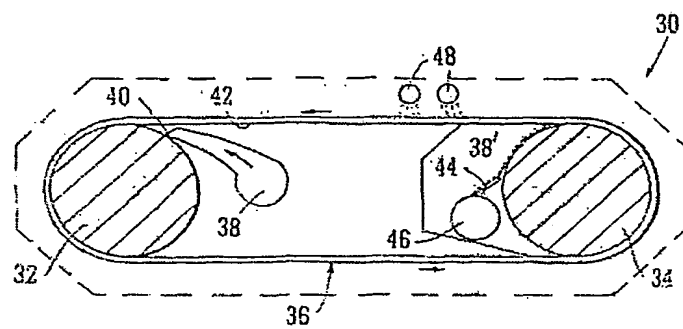


FIG. 6
PRIOR ART

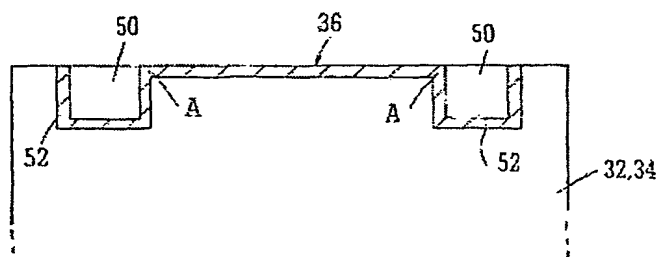


FIG. 7
PRIOR ART

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D33/04 D21F1/00 B29D29/00 B29C67/00 B01D39/14
B29C43/22 B32B27/12 D21D5/04 D21F1/80

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D D21F B32B D21D B29C B29D D03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

6 August 2004

Date of mailing of the international search report

31/08/2004

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2004/050250

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